

Appendix B  
Master Drilling Plan

## **Appendix B**

### **MASTER DRILLING PLAN (MDP) JOLLY ROGER UNIT ALPHA POD PLAN OF DEVELOPMENT (POD)**

**OPERATORS (The Companies):  
Warren E & P, INC. (Warren)  
Anadarko E&P Company (Anadarko)**

**Drilling Plan for the subject wells listed below:**

**CBM Wells in Section 32 (WYW-148977)**

1. AR Federal 1990-SE 32
2. AR Federal 1990-SW 32

**CBM Wells in Section 4 (WYW-148973)**

1. AR Federal 1890-NW 4
2. AR Federal 1890 – SW 4

**CBM Wells in Section 6 (WYW-148973)**

1. AR Federal 1890-NE 6
2. AR Federal 1890-SE 6

**CBM Wells in Section 8 (WYW-129066)**

1. AR Federal 1890-NE 8
2. AR Federal 1890-SW 8
3. AR Federal 1890-SE 8

**CBM Wells in Section 18 (WYW-129066)**

1. AR Federal 1890-NE 18

**1. ESTIMATED TOPS OF IMPORTANT GEOLOGIC MARKERS**

<b>Formation</b>	<b>Depth</b>
Lewis Shale	Surface
Isolated Sands in Lewis	1,460' – 4,870'
Shale	1,952' – 5,360'
Almond	2,212' – 5,620'
Pine Ridge	2,492' – 5,900'
Allen Ridge	2,710' – 6,400'
TD (CBM Wells)	7,670' – 8,460'
Cherokee/Deep Creek Sandstones	

**2. ESTIMATED DEPTH OF ANTICIPATED WATER, OIL, GAS OR MINERAL FORMATIONS**

Almond	Methane gas
Pine Ridge	Methane gas
Allen Ridge	Methane gas

The Lewis Shale is not anticipated to contain any zones capable of producing water. There are several zones within the Mesaverde Group capable of producing fresh water, including the coal seams. The Companies propose to test the productive formations between 1,952' and 5900'. Several coal seams may be tested for gas production to total depth. All shallow water zones will be protected with casing and cement. Cement will be brought above the base of the Lewis Shale to isolate all formations in the Mesaverde Group.

**Planned Objective for CBM Wells: Mesaverde**

**3. MINIMUM BLOW OUT PREVENTOR (BOP) REQUIREMENTS (refer to attached schematics)**

1. The BOPE will conform to Onshore Shore Order #2. The blowout preventer equipment will consist of 2000 psi W.P. Double Ram, Hydraulic Preventer is enclosed. All fill and kill lines will be 2000 psi W.P. The producing CBM wells in this area have shut-in surface pressures ranging from 180 to 600 psi after the coal has been dewatered. Therefore we are planning on testing the BOP's to 1000 psi. There will be no pressure control (BOP's) for the surface hole section from 0 to 640' MD. (See Attached Schematic).
2. The BOP shall be pressure tested when initially installed, whenever any seal subject to pressure testing is broken, after repairs, or every 30 days.
3. The Companies shall notify the Rawlins BLM office 24 hours prior to the BOP test.

#### 4. SUPPLEMENTAL INFORMATION

The primary objective of this project is to drill, stimulate, and produce methane gas from coal seams in recognized gas-producing formations of the Mesaverde Group. The coal seams are overpressured and are very unlikely to be in communication with overlying layers. Produced water will be injected in one of two deep injection wells completed in the Cherokee/Deep Creek Sandstones or in one of four shallow wells that would recharge sand units in the Lewis Shale. One of the deep injection wells and two of the shallow wells that are proposed would be federal wells.

The deep injection zone in the Cherokee/Deep Creek Sandstones is isolated above and below by competent shale barriers. Maximum pressure requirements for the injection zone would be established through injectivity tests that would identify fracture pressure limits to prevent the overlying shale from being breached by the initiation and propagation of fractures through overlying strata to any zones of fresh water. Injection horizons will not be exceeded based on injectivity tests and applicable permit limits, as regulated by the State of Wyoming and BLM. The minimum injection rate for each deep injection well is projected to be 5,000 bbls per day, and the maximum rate is projected to be 20,000 bbls per day. These deep sands are limited reservoirs and it may be necessary to find deeper reservoirs if they become filled to capacity. There are a number of deeper reservoirs that could be utilized.

The isolation of the shallow injection zone within the Lewis Shale is not as complete as the deep injection zone. In addition, it is highly unlikely that large quantities of water can be disposed of in these sands, since these sands that occur parallel to the outcrop appear to have little or no connection to a deep and extensive aquifer. Disposal of produced water in shallow wells would be monitored along the outcrop of the Lewis Shale, downdip (down structure) from disposal wells, to verify that produced water is not transferred laterally and, subsequently, does not resurface along the outcrop and compromise groundwater or surface water (increasing the salt load). Inventory and monitoring also would verify that disposal wells do not conduct water to surface springs or seeps. Shallow injection of produced water would cease if lateral transport of produced water were detected.

The proposed injection wells that would be located on BLM surface ownership lands are listed in the MDP to provide a comprehensive listing of the federal wells included in the POD for the Jolly Roger Unit Alpha area. The Wyoming Department of Environmental Quality (WDEQ) would permit these wells.

The coal seams will be perforated and stimulated by hydraulic enhancement or fracturing during testing. Fresh water, gelled water, and/or foam fracturing techniques will be used.

The following schematics that show typical facilities, operating standards, and methodologies, are attached to this MDP: B.O.P.; Bottom Flange; Configuration Options; Completed CBM Well; and Injection Well. Additional schematics for this POD are attached to the Master Surface Use Program (MSUP): CBM Drill Site Layout; CBM Well Site; Water Disposal Facility; Water Transfer Facility; and Compressor Station.

**5. CASING PROGRAM**

<u>Hole Size</u>	<u>Casing Size</u>	<u>Casing Wt.</u>	<u>Grade</u>	<u>Joint</u>	<u>Depth Set</u>	<u>New/Used</u>	<u>Rng</u>
12 1/4"	9 5/8"	32.3#	H-40	ST&C	<b>10% of well depth</b>	New	3
9 7/8"	7"	23#	MC-50	LT&C	0-TD	New	3
<b>Surface Casing:</b>	10 3/4"	32.3 ppf.	H-40	STC	<b>Collapse Ratings:</b>	Burst 2270	Tension 2254M

**A.** Burst =  $[0.052 * FG * TVD (shoe)] - [Gas Gradient * TVD]$   
 $= [0.052 * 9.3ppg * 640'] - [0.1psi/ft * 640']$   
 $= 246 \text{ psi}$   
 Safety Factor = Rating/Burst  
 $= 2270/246$   
 $= 9.23$

**B.** Collapse =  $0.052 * MW * TVD (shoe)$   
 $= 0.052 * 8.8ppg * 640'$   
 $= 293 \text{ psi}$   
 Safety Factor = Rating/Collapse  
 $= 1370/293$   
 $= 4.68$

**C.** Tension =  $Weight * MD * [1 - (MW/65.5ppg)]$   
 $= 32.3ppf * 640' * [1 - (8.8ppg/65.5ppg)]$   
 $= 17895 \text{ lbs.}$   
 Safety Factor = Rating/Tension  
 $= 254,000/17895$   
 $= 14.2$

Surface casing shall have centralizers on the bottom 3 joints of the casing, starting with the shoe joint.

<b>Production Casing:</b>	7"	23 ppg.	MC-50	STC	Collapse	Burst	Tension
				<b>Ratings:</b>	3110	3960	273M

A.  $Burst = [0.052 * 8.4ppg * 6400'] - [0.2psi/ft * 6400']$   
 $= 1515 \text{ psi} **$

Safety Factor = Rating/Burst  
 $= 3960/1515$   
 $= 2.61$

B.  $Collapse = 0.052 * 8.4 \text{ ppg} * 6400' - (.1 \text{ psi/ft} * 6400')$   
 $= 2155 \text{ psi}$

Safety Factor = Rating/Collapse  
 $= 3110/2155$   
 $= 1.44$

C.  $Tension = 23 \text{ lbs./ft} * 6400' * [1 - (10 \text{ ppg}/65.5 \text{ ppg})]$   
 $= 23 \text{ lbs./ft} * 6400' * .8473$   
 $= 124,723 \text{ lbs.}$

Safety Factor = Rating/Tension  
 $= 273,000/124,723$   
 $= 2.19$

\*\* Our actual shut in tubing pressures in the Atlantic Rim area range from 180 to 600 psi.

## 6. MUD PROGRAM

Drilling mud will be used as the circulation medium. A fresh water, polymer, gel drilling mud will be used and visual monitoring will be done from spud to total depth. The anticipated mud weight will be between 8.5 – 10 ppg . Sufficient quantities of lost circulation material and barite will be available at the well site at all times for the purpose of assuring well control.

## 7. CEMENTING PROGRAM

The following is the proposed procedure for cementing the 9 5/8" surface pipe and 7" long string:

### Surface Casing:

Lead: Class "C" Type III, 14.4 ppg., yield 1.44ft<sup>3</sup>/sk @ 101% excess.  
 Compressive strength in 24 hours at 80°F 3100psi.

The surface casing shall be cemented back to surface. In the event cement does not circulate to surface or fall back of the cement column occurs, remedial cementing shall be done to cement the casing back to surface.

**Long String:**

Lead: Class “C” Type III, 14.4 ppg., yield 1.44ft<sup>3</sup>/sk @ 35% excess.  
Compressive strength in 24 hours at 95°F 3200psi.

Cementing plan is to bring cement back to surface. In the event cement is not circulated to surface, a temperature log will be run to indicate the cement top and this will be communicated back to the BLM. If the cement top is inside the surface casing no remedial cement work will be performed.

**8. LOGGING PROGRAM**

**Cores:** Rotary Cores will be taken as needed to evaluate the coal seams.

**DSTs:** None Planned

**Logs:** Induction, GR, SP, Density, Neutron and Caliper – From surface to TD  
Cement Bond Log – From 10 ¾” casing shoe to TD  
Mud Logger – As Needed.

**9. PRESSURE DATA AND POTENTIAL HAZARDS**

Bottom hole pressures anticipated @ 1180 – 2800 psi.  
There is no history of hydrogen sulfide gas in the area and none is anticipated.

**10. ANTICIPATED STARTING DATES AND NOTIFICATION OF OPERATIONS**

**A. Anticipated Starting Dates:**

Anticipated Commencement Date	- Fall 2004, or upon approval
Drilling	- Approximately 7 days per well
Completion	- Approximately 2 days per well
Initial Testing	- Approximately 7-14 days per well
Production Testing	- Approximately 6-12 months per well

Note: Drilling operations will commence as soon as practical after approval of all necessary permits including the Applications for Permits to Drill (APDs).

**B. Notification of Operations:**

Rawlins Field Office, BLM  
1300 North Third  
Rawlins, Wyoming 82301  
(307) 328-4200